

**BUREAU OF ENVIRONMENTAL REMEDIATION POLICY
MONITORED NATURAL ATTENUATION**

BER POLICY # BER-RS-042

DATE: March 30, 2001

Revised 12/18/2005

TOTAL PAGES: 5

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Date: *3/30/2001*

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The Kansas Department of Health and Environment - Bureau of Environmental Remediation (KDHE-BER) is committed to evaluating and considering proposals for Monitored Natural Attenuation (MNA) of certain contaminants at suitable contaminated sites across Kansas. KDHE-BER remains fully committed to the goal of protecting human health and the environment by: reducing the volume and toxicity of contaminants, hazardous substances, or pollutants through treatment; restoring contaminated ground water to its most beneficial uses preventing the uncontrolled migration of contaminated ground water; preventing the degradation of surface water quality by contaminated ground water; and protecting all other environmental resources in Kansas. MNA is a remedial alternative that may be evaluated and compared with other applicable remedies at a contaminated site. MNA is not a default remedy; KDHE-BER considers MNA to be an alternative means of achieving remediation goals in certain circumstances where all applicable statutory and regulatory requirements are met by MNA and where site-specific conditions are conducive to MNA. KDHE-BER does not allow the further degradation of contaminated media through MNA.

United States Environmental Protection Agency (USEPA) OSWER Directive 9200.4-17P serves as the basis for KDHE-BER's MNA policy and should be referenced. If the contaminant of concern is a chlorinated solvent, the USEPA document "Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater" (EPA/600/R-98/128) should also be consulted. BER Policy # BER-RS-042 provides further clarification of additional KDHE-BER requirements to the guidance provided by EPA Directive 9200.4-17P.

The term MNA as used in the EPA Directive and the KDHE-BER policy refers to the reliance on natural attenuation processes to achieve site-specific remediation objectives within the context of a carefully controlled and monitored site cleanup approach and within a time frame that is reasonable compared to other more active methods. The "natural attenuation processes" that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil and/or groundwater. These in-situ processes include: biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants.

All approvals for MNA shall be made on a site-specific basis in accordance with this policy by the KDHE Project Manager, Program Manager, and Section Chief. The Bureau Director may also be consulted in the approval process. Ultimately, the Secretary of KDHE has the authority to require cleanup and determine the manner of that cleanup at contaminated sites in Kansas.

Criteria for Determining When MNA May Be Appropriate: A proposal for MNA must be submitted to KDHE-BER and must evaluate in writing each of the following:

- 1) Threat to Human Health - The proposal shall document that MNA will not pose an unacceptable risk to human health. All potential current and future targets/exposure receptors must be identified and demonstrated not to be impacted or threatened. MNA will not be approved in situations where public or private drinking water wells have been impacted or are threatened to be impacted above human health-based goals as defined by the Risk-based Standards for Kansas (RSK) Manual. MNA of soil will not be approved when surface soil contaminant concentrations exceed the human health-based goals, as defined by the RSK Manual and amendments thereto, and when access to the site is unrestricted. MNA may not be approved in cases where the persistence of degradation products presents a greater risk than the parent contaminant(s).
- 2) Degradation of Ground Water - The proposal shall document that MNA will not allow continued degradation of ground water quality. The MNA proposal must demonstrate that the ground water contaminant plume is stable or shrinking and that no additional migration of contamination is occurring. MNA of soils is not appropriate where downward leaching of the contaminants in the soil column may contaminate ground water to levels above the ground water goals for the site. KDHE has calculated soil concentrations that are generally protective of ground water; these soil concentrations are included in the RSK Manual.
- 3) Degradation of Surface Water - The proposal shall evaluate the potential for degradation of surface water quality via surface runoff or ground water discharge to surface water. MNA is not an acceptable remedial approach for sites where contamination is already impacting or threatening surface water quality.
- 4) Threat to Other Potential Receptors - The proposal shall determine if there will be an impact to wildlife, vegetation, domestic animals, or farm stock. This should include an evaluation of potential migration to off-site locations through underground trenches, tile lines, storm water and other drainage systems.
- 5) Time Frame and Cost - The proposal shall provide documentation that MNA will achieve the site cleanup goals, as determined by KDHE-BER, within a reasonable time frame and in a cost-effective manner when compared to other viable corrective action alternatives for the site. The costs of implementing MNA, including long-term monitoring, financial assurance, and a contingency plan, shall be fully evaluated and compared with the costs of other remediation strategies that meet the site cleanup goals in a shorter time frame.
- 6) Property Control - The proposal must document that the responsible party owns all impacted property or is otherwise able to exert legal control over uses of such property. Plumes that impact other parties' properties shall not be considered for MNA unless each property owner grants permission in writing or there is a local ordinance to prevent human exposure to off-site contaminants including appropriate land use controls.
- 7) Resource Management – The current and projected demand for the affected resource over the time period that the remedy is in use may influence KDHE's decision to approve MNA at a contaminated site.

Site Characterization To Determine If Site Is Suitable For MNA: The suitability of a site for MNA must be demonstrated on the basis of site-specific physical and chemical properties. Decisions to employ MNA as a remedy or remedy component should be documented thoroughly with site-specific data. The characterization requirements for each site may vary based on site-specific parameters such as contaminant levels, site-specific clean-up goals, and the potential for contaminants to degrade in the site hydrogeological setting. Any deviations from the requirements listed below must be approved by the KDHE-BER Project Manager, Program Manager, and Section Chief and must be documented in writing. Site characterization requirements are:

- 1) A KDHE-approved investigation report that includes:
 - a) Identification and characterization of all potential source areas, including identification of all chemicals of concern, mechanisms of release, estimation of the quantities of release, and whether these releases are ongoing or inactive;
 - b) Delineation and characterization of the full lateral and vertical extent of contamination for each of the impacted environmental media at the site;
 - c) Characterization of the environmental setting, including regional and local geology, hydrogeology, and hydrology; particularly as those site physical characteristics pertain to contaminant transport and fate mechanisms for the site or affect the evaluation, selection and design of cleanup alternatives for the site;
- 2) Historical ground water and soil chemistry data that clearly demonstrate a decreasing trend of contaminant mass and/or concentration over time at appropriate monitoring or sampling points must be provided. The site data must demonstrate that further degradation of the aquifer is not occurring. The plume must be demonstrated to be stable or diminishing in vertical and lateral extent. Four consecutive quarterly sampling episodes from the same monitoring wells are required, at a minimum, to begin to make such evaluation.
- 3) Hydrogeologic and geochemical data must be collected to demonstrate the MNA processes active at the site and the rate at which such processes are reducing contaminant concentrations. Specific parameters including but not limited to those listed below, should be evaluated to demonstrate the efficacy of MNA. "Evaluation" can consist of demonstrating that a specific parameter is not applicable to the site; for instance, hydrogen data may not be necessary at sites where vinyl chloride is not expected to be a daughter product in the degradation pathway, or is being detected at the concentrations expected under the site conditions.
 - a) dissolved oxygen
 - b) soil and groundwater pH
 - c) redox potential
 - d) temperature
 - e) alkalinity
 - f) sulfate
 - g) sulfide
 - h) methane

- i) ethane/ethene
- j) total organic carbon
- k) chloride
- l) iron
- m) nitrogen
- n) nitrate
- o) nitrite
- p) carbon dioxide
- q) manganese
- r) hydrogen
- s) conductivity
- t) concentration of the contaminant(s) of concern and daughter products of contaminant decay
- u) microorganisms present
- v) any others, as appropriate for site-specific conditions and contaminant(s)

KDHE may require that characterization include sampling for contaminants that are not site COCs but could alter the rate of COC degradation if present.

4) Data from microcosm studies.

Monitoring Requirements: A monitoring plan is required for any MNA site. The monitoring plan shall include monitoring procedures, which will confirm that: 1) degradation mechanisms remain active; 2) contaminant mass, volume and area are decreasing over time; and 3) contaminant decreases are due to attenuation and not migration of contaminants. At a minimum, the contaminant concentrations shall be monitored at a frequency approved by the department and based on documented site-specific information to establish that concentrations are decreasing over time. Monitoring will be required until contaminant levels reach site cleanup goals and KDHE-BER approved post-cleanup verification sampling is completed.

Other Requirements:

1) A **Source Control Plan** must be developed, approved by KDHE-BER, and implemented by the voluntary or potentially responsible party to address active source areas or hot spots before or while MNA is being implemented. Hot spots include areas where free product or high concentrations of contaminants are present in soil and/or ground water.

2) A **contingency plan** must be developed and approved by KDHE-BER for remediation/control of the uncontrolled portion of the contaminated plume in the event that MNA proves ineffective. The contingency plan should identify monitoring criteria that would require initiation of the contingency plan. For example, the contingency plan would be implemented if it is determined that the plume is continuing to migrate and/or impacting or threatening potential receptors and/or is violating KDHE's position on degradation of ground water and surface water.

3) **Environmental Use Controls (EUCs)** also known as Institutional controls, may be required on all impacted property at which MNA is approved as the remedy. The EUCA must restrict future land use and inform all future landowners of the nature of environmental conditions present at the property.

4) The KDHE-BER may determine that **financial assurance** is required for the EUCA and MNA action to implement the contingency plan in the case that the voluntary or responsible party is not financially able to perform the required actions. The Project Manager, Program Manager, and Section Chief must approve all financial assurance instruments.

In summary, KDHE-BER's decision to implement MNA at a contaminated site will be based on appropriate site characterization, KDHE-BER approved site-specific cleanup goals, legal control of the impacted property/ies, and the successful implementation of measures to control all sources and/or hot spots. Additionally, the progress of MNA towards site cleanup goals must be carefully monitored and compared with expectations to ensure that it will meet those cleanup goals within a time frame that is reasonable compared to time frames associated with other potential site remedies. Contingencies, EUCAs, and financial assurances will be required by KDHE-BER at some sites to assure that MNA meets the agency's expectations. Approval of MNA as a remedial approach does not waive KDHE's right to seek any Natural Resource Damages.